

Why is Convertible Debt Subordinated? An Investment-Based Agency Theory

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ABSTRACT

This paper offers an agency-based explanation for the junior priority status of convertible bonds. Using a simple economic model I show that when convertible and straight debt have equal priority, shareholders can prefer negative-NPV projects, which results in wealth transfers from bondholders to shareholders; and I prove that this problem is solved when convertible debt is subordinated. Empirical evidence supports the theory. I find that firms with greater potential for investment-based agency conflicts are more likely to issue subordinated convertible debt, and firms with senior convertible debt are more likely to deviate from the optimal investment policy.

Keywords: convertible debt; investment; agency costs

JEL Classifications: G31; G32; G33

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1. Introduction

Corporate finance literature has identified several reasons for issuing convertible debt. These include reducing the cost of information asymmetry associated with equity financing (Stein, 1992), addressing uncertainty about current and future firm risk (Brennan and Kraus, 1987; Brennan and Schwartz, 1988), controlling for overinvestment incentives (Mayers, 1998), and mitigating the asset substitution problem (Green, 1984). However, little attention has been paid to what underlies the priority status of convertible debt, in particular, to the evidence that most convertible bonds have lower priority than straight, non-convertible, bonds. Wilson and Fabozzi (1996) report that almost all convertible debt is subordinated to non-convertible claims. Krishnaswami and Yaman (2004) find that 93% of convertible bonds issued between 1983 and 2002 is subordinated.

In this paper I propose an explanation for the junior priority status of convertible debt, which is based on an investment-related conflict of interests between equityholders and debtholders. Using a simple economic model, I show first that providing convertible debtholders with the same priority rights as straight debtholders can produce an incentive for equityholders to accept projects with negative net present value (NPV), which results in a wealth transfer from bondholders to shareholders. I then prove that this potential problem is solved when the convertible debt is subordinated.

The idea is that convertible and straight debt having equal priority implies that the convertible debtholders dilute either existing shareholders' claims (if they convert) or straight debtholders' claims (if they do not convert). Since the value of the conversion

option increases with firm value, the shareholders can prevent a conversion (and therefore dilute the straight debt, rather than the equity) by reducing firm value. This means that shareholders can have incentives to accept negative-NPV projects if the benefits from preventing conversion are sufficiently high. However, if the convertible debt is subordinated to the straight debt, the conversion decision cannot dilute the straight debt. Thus, the shareholders cannot transfer wealth from the bondholders by undertaking poor projects that prevent debt conversion when the convertible debt is subordinated.

My theory on the potential for an agency conflict when convertible debt is non-subordinated is consistent with the documented dominant junior priority status of convertible bonds. I further test the following implications of the theory. First, for contracting costs considerations, subordinated convertible debt is more likely to be issued by firms with greater potential for investment-related shareholder-bondholder conflicts (i.e., smaller firms with more growth opportunities, unregulated firms, and firms where manager and shareholder interests are aligned). Second, firms with senior convertible debt are more likely than firms with subordinated convertible debt to deviate from an optimal investment policy. Empirical evidence using 35 years of data supports both predictions.

The contribution of this paper to the corporate finance literature is twofold. First, I present a potential agency conflict between bondholders and shareholders. Well-known investment-based agency conflict studies, such as Jensen and Meckling's (1976) asset substitution problem and Myers' (1977) underinvestment problem, show that under certain conditions shareholders in highly levered firms can have incentives to deviate from the optimal investment policy. Along this line, I show that a certain debt structure (i.e., non-subordinated convertible debt) can produce shareholder incentives to engage in

negative-NPV projects, and provide a solution to the problem (i.e., making convertible debt subordinated) that is consistent with the empirical findings.

Second, my results are informative with respect to the determinants of firms' capital structure choices, and in particular, the priority structure of debt. Smith and Watts (1992) and Rajan and Zingales (1995) provide evidence indicating that firms issue less debt to mitigate potential agency conflicts. Barclay and Smith (1995a, 1995b) argue further that expected agency costs affect not only the amount of debt issued but also its maturity and priority structure. Stulz and Johnson (1985) show theoretically that issuing new senior debt can mitigate underinvestment incentives. Welch (1997) explains the seniority of bank debt by the ability of banks to compete with shareholders in situations of financial distress. Consistent with these studies, I explain the observed junior priority status of convertible bonds by an investment-based agency conflict.

2. Agency conflict in the presence of convertible debt

2.1 Incentive to take poor projects when convertible debt is non-subordinated

The model I present demonstrates first that in the presence of non-subordinated convertible debt, negative-NPV projects can be more favorable to shareholders than positive-NPV projects, which imposes costs on bondholders. The assumptions are:

1. At date 0, the firm's only asset is cash in the amount of I , which can be invested in one of two projects, A or B. Both projects require an investment of I and have the same volatility. The difference between them is that project A has a positive NPV ($\mu > 0$), and project B has a negative NPV ($-\mu$). At maturity, the value of project A will be either $[I + \mu + \delta]$ or $[I + \mu - \delta]$ with equal probability, whereas project B will

be worth either $[I - \mu + \delta]$ or $[I - \mu - \delta]$ with equal probability, where the parameter $\delta > 0$ represents the volatility of the two projects.

2. The firm's capital structure includes common equity and debt, with a face value of D .
3. The share of convertible debt in the total debt is given by $0 \leq \alpha \leq 1$; and at conversion, the share of the equity that will be held by the convertible bondholder is $0 \leq q \leq 1$. For simplicity, assume a single straight (non-convertible) bond, a single convertible bond, and a single share, held by three different agents.
4. The straight and convertible bonds have the same priority. (This assumption drives the agency problem, as shown later).
5. There are no taxes, bankruptcy costs, or information asymmetries between the agents.
6. All agents are risk-neutral, and the risk-free rate is zero.
7. The value maximizing shareholder controls the firm.
8. Time line: At date 0 the shareholder makes the investment decision. At date 1 the convertible bondholder, who knows the expected payoffs of the two projects and which project is taken, makes the conversion decision. And at date 2 the value of the investment is realized, the debt matures, and the firm is liquidated.¹

Figure 1 presents the payoff structure of the model. For the shareholder to be better off with the negative-NPV project (B), three conditions must hold simultaneously:

- (i) If project A is taken, the convertible bondholder will convert:

$$\frac{1}{2} \{q \max[0, I + \mu + \delta - (1 - \alpha)D] + q \max[0, I + \mu - \delta - (1 - \alpha)D]\} > \frac{1}{2} \{\alpha \min[D, I + \mu + \delta] + \alpha \min[D, I + \mu - \delta]\} \quad (1)$$

- (ii) If project B is taken, the convertible bondholder will not convert:

¹ Note that the investment payoff is realized only after the convertible bondholder makes the conversion decision. I justify this assumption in Section 2.5.

$$\frac{1}{2}\{q \max[0, I - \mu + \delta - (1 - \alpha)D] + q \max[0, I - \mu - \delta - (1 - \alpha)D]\} < \frac{1}{2}\{\alpha \min[D, I - \mu + \delta] + \alpha \min[D, I - \mu - \delta]\} \quad (2)$$

(iii) The shareholder's claim has a higher value if project B is taken and the bond is not converted than if project A is taken and the bond is converted:

$$\frac{1}{2}\{(1 - q) \max[0, I + \mu + \delta - (1 - \alpha)D] + (1 - q) \max[0, I + \mu - \delta - (1 - \alpha)D]\} < \frac{1}{2}\{\max[0, I - \mu + \delta - D] + \max[0, I - \mu - \delta - D]\} \quad (3)$$

Thus, a set of values of the parameters $[I, D, \mu, \delta, \alpha, q]$ that satisfy inequalities (1)-(3) implies shareholder incentive to take the bad project. An example is demonstrated below.

2.2 Numerical example

Setting the model's parameters to the following values illustrates the agency problem and its costs: $I = 120$; $D = 100$; $\mu = 10$; $\delta = 74$; $\alpha = 0.5$; $q = 0.5$. That is, the firm has cash in the amount of 120, which will be invested in either project A or B; project A will be worth either 204 or 56 with equal probability (NPV=10), whereas project B will be worth either 184 or 36 with equal probability (NPV=-10). The face value of the firm's debt is 100, where half of the debt is convertible, and upon conversion half of the equity will be held by the convertible bondholder.

Figure 2 presents the payoff structure. Solving for the equilibrium by backward induction shows that the shareholder will choose the negative-NPV alternative (project B). Why does this happen? The shareholder knows that only project A will lead to conversion, which means a dilution of the equity value; and since the value of the diluted equity if the positive-value project (A) is undertaken is lower than the value of the undiluted equity if the negative-value project (B) is undertaken, the shareholder chooses

project B. In other words, the shareholder prefers the negative-NPV project because the benefits from preventing debt conversion are higher than the costs associated with the reduction in firm value.

The figure also summarizes the wealth transfers from the bondholders to the shareholder as a result of choosing project B over project A. Note that most of the costs are imposed on the straight bondholder, and not on the convertible bondholder (-16 and -6, respectively). This is because the value of the straight bond is significantly diluted when the convertible bond is not converted.

2.3 The feasibility of the investment distortion

To provide a general assessment of the feasibility of the investment distortion, I examine under what parameter values the shareholder will benefit from choosing the poor project over the good project. Figure 3 displays the regimes at which the investment distortion can arise for different levels of leverage ratio (D/I), the share of convertible debt in the total debt (α), and the share of the equity that will be held by the convertible bondholder upon conversion (q). That is, the shaded areas in the figure indicate the sets of values ($D/I, \alpha, q$) for which there exists a set of pairs of projects with a positive and a negative NPV ($\mu > 0$ and $-\mu$, respectively) and the same volatility (δ), such that the shareholder will be better off with the negative-NPV one.

The figure reveals several results. First and most important, there is a wide range of parameter values at which the shareholder has an incentive to reduce the firm's value, assuring that the agency problem identified in this study is not driven by specific scenarios. Second, the extent of the agency problem increases with the leverage ratio. This result is expected as higher leverage implies higher default risk at which the straight

bondholder will be more affected by the conversion decision. Third, even at the lower leverage ratio of 50%, the shareholder can have an incentive to choose poor projects to prevent debt conversion (although only under very limited values of α and q).

Fourth, the set of values of (α, q) under which investment distortion incentives exist can be characterized by two regimes. The first regime is the upward shaded area that appears at the low leverage ratio and expands with leverage. This indicates a positive relation between the values of α and q under which the investment distortion can arise. This pattern is intuitive as it is easier for the shareholder to affect the conversion decision using the investment policy when the convertible bondholder holds similar stakes in the firm's debt and equity. The second regime represents very high values of q , which appears only at the higher leverage ratio (80% and above). That is, since the value of the equity is relatively small when leverage is high, the shareholder can have a strong incentive to prevent debt conversion that would further significantly dilute her claim (implied by the high q); i.e., a strong incentive to choose poor projects that decrease firm value. When the leverage ratio becomes very high (over 90%) the two regimes are collapsed into one big area, suggesting that investment distortions can arise under most of the value combinations of α and q .

2.4 Solving the problem by making convertible debt subordinated

The problem demonstrated above occurs because the straight and convertible bonds have equal priority. In this case, the value of the straight bond will be diluted if the convertible bond is not converted. This means that the shareholder can transfer wealth from the straight bondholder by eliminating the incentive of the convertible bondholder to convert, i.e., by choosing the negative-NPV project. If the convertible bond is subordinated to the straight bond, however, the value of the straight bond will not be affected by the

conversion decision. Hence, the shareholder cannot transfer wealth from the bondholders by accepting the poor project.

Proposition: *When convertible debt is subordinated to straight debt, the shareholder will always prefer the positive-NPV project.*

Proof: Following the same set up outlined in Section 2.1, assume now that the convertible bond is subordinated to the straight bond. Figure 4 presents the payoff structure, where the differences from Figure 1 are in the payoffs to the bondholders when there is no conversion.

As discussed above, for the conflict to exist, three conditions must hold simultaneously:

(i) If project A is taken, the convertible bondholder will convert:

$$\frac{1}{2}\{q \max[0, I + \mu + \delta - (1 - \alpha)D] + q \max[0, I + \mu - \delta - (1 - \alpha)D]\} > \frac{1}{2}\{\max[0, \min[\alpha D, I + \mu + \delta - (1 - \alpha)D]] + \max[0, \min[\alpha D, I + \mu - \delta - (1 - \alpha)D]]\} \quad (4)$$

(ii) If project B is taken, the convertible bondholder will not convert:

$$\frac{1}{2}\{q \max[0, I - \mu + \delta - (1 - \alpha)D] + q \max[0, I - \mu - \delta - (1 - \alpha)D]\} < \frac{1}{2}\{\max[0, \min[\alpha D, I - \mu + \delta - (1 - \alpha)D]] + \max[0, \min[\alpha D, I - \mu - \delta - (1 - \alpha)D]]\} \quad (5)$$

(iii) The shareholder's claim has a higher value if project B is taken and the bond is not converted than if project A is taken and the bond is converted:

$$\frac{1}{2}\{(1 - q) \max[0, I + \mu + \delta - (1 - \alpha)D] + (1 - q) \max[0, I + \mu - \delta - (1 - \alpha)D]\} < \frac{1}{2}\{\max[0, I - \mu + \delta - D] + \max[0, I - \mu - \delta - D]\} \quad (6)$$

In addition, two default conditions also are necessary for the existence of the conflict.

The first condition is that if the convertible bond is not converted and the negative-value

project succeeds, then the proceeds to the shareholder are strictly positive. If this condition does not hold, there will be no incentive for the shareholder to choose the poorer project. That is:

$$[I - \mu + \delta] > D \quad (7)$$

The second condition is that if the negative-value project fails, there is a default for the straight bond. If this condition does not hold, the value of the straight bond will never be affected by the investment and the conversion decisions. That is:

$$[I - \mu - \delta] < (1 - \alpha)D \quad (8)$$

Using inequalities (7) and (8), the three conditions (i)-(iii) can be simplified to:

$$q(I + \mu + \delta - (1 - \alpha)D) + q \max[0, I + \mu - \delta - (1 - \alpha)D] > \alpha D + \max[0, \min[\alpha D, I + \mu - \delta - (1 - \alpha)D]] \quad (9)$$

$$q(I - \mu + \delta - (1 - \alpha)D) < \alpha D \quad (10)$$

$$(1 - q)(I + \mu + \delta - (1 - \alpha)D) + (1 - q) \max[0, I + \mu - \delta - (1 - \alpha)D] < I - \mu + \delta - D \quad (11)$$

Inequalities (9) and (11) yield the following inequality:

$$\frac{q}{(1 - q)}(I - \mu + \delta) > \left(\frac{q}{(1 - q)} + \alpha \right) D + \max[0, \min[\alpha D, I + \mu - \delta - (1 - \alpha)D]] \quad (12)$$

And inequality (10) can be written as:

$$\frac{q}{(1 - q)}(I - \mu + \delta) < \left(\frac{q}{(1 - q)}(1 - \alpha) + \frac{\alpha}{(1 - q)} \right) D \quad (13)$$

And since $\left(\frac{q}{(1 - q)} + \alpha \right) = \left(\frac{q}{(1 - q)}(1 - \alpha) + \frac{\alpha}{(1 - q)} \right)$, inequalities (12) and (13) then imply that:

$$\max[0, \min[\alpha D, I + \mu - \delta - (1 - \alpha)D]] < 0 \quad (14)$$

Obviously, inequality (14) cannot be satisfied. This contradiction implies that conditions (i)-(iii) cannot hold simultaneously for any values of the model's parameters. That is, the shareholder will always prefer the positive-NPV project when the convertible bond is subordinated. ■

2.5 Discussion

The theory in this study assumes optimal decisions by both the shareholder and the convertible bondholder when taking into account the primary feature of convertible bonds, namely, the conversion option. I argue that the results still hold when considering additional characteristics of convertible debt.

Call provisions. Most convertible bond issues include call provisions that give shareholders the right to call back the bonds and thereby to force a conversion decision (see Korkeamaki and Moore, 2003). Typically, a company must give bondholders a notice period to decide whether to convert the bonds or not (usually 30 days; see, for example, Altintig and Butler, 2005), which means that the convertible bondholders retain the option to convert the bonds even after a call notice. This implies that shareholders cannot use call provisions to preclude a debt conversion that will dilute the value of their claims. That is, call provisions do not provide an alternative to choosing poor projects in preventing debt conversion, and therefore do not mitigate the agency problem identified in this study.

Coupon payment and dividend. My model does not take into account either a coupon payment to the convertible bondholder before conversion, or a dividend paid to the convertible bondholder after conversion. Clearly, the incentive to convert will increase with the dividend and decline with the coupon payment. As both the coupon payment and the dividend can be expected by all agents, though, incorporating the two into the model

might change the value of the conversion option, and thus the range of the firm value over which the conflict occurs, but will not affect either the incentive or the ability of the shareholder to prevent a conversion by deviating from the optimal investment policy.

Conversion timing. My model assumes that the convertible bondholder will convert the bond after the investment decision and before the investment realization. That is, once the investment decision is made, if the conversion option is in-the-money, the bond will be converted. One can argue that the convertible bondholder might be better off waiting until the maturity date to make the conversion decision. Yet, the empirical evidence suggests that if the conversion option is in-the-money, convertible bondholders tend to exercise the conversion option as long as it is feasible to convert (see, for example, Asquith and Mullins, 1991). Furthermore, convertible debt contracts often specify periods during which conversion is forbidden or restricted to prevent expected early conversion.

One can further argue that if the poor project is taken and thus the bond is not converted immediately (the conversion option is out-of-the-money), the convertible bondholder could still convert if she finds out that the project succeeds just before the bond matures. It is however very difficult to implement this type of strategy in practice. That is, for simplicity the model assumes that all bonds' maturities and the investment realization appear exactly at the same time. But it is very likely that the outcomes of many of the firm's investments are revealed after the maturity of the debt, or after the periods at which bonds can be converted to common shares. And although the realization of those investments affects the firm's default risk, the convertible bondholders do not have enough information about the investments' terminal values to make a conversion decision when approaching the maturity date. The empirical evidence supports this

argument, as typically convertible bonds are either converted to shares long before maturity or not converted at all (see, for example, Asquith and Mullins, 1991; Altintig and Butler, 2005).

3. Empirical tests

3.1 Predictions

Demonstrating a costly agency conflict that can arise only when convertible debt is non-subordinated is consistent with the documented junior priority status of convertible bonds. In addition, the theory has the following two empirical implications. The first follows the contracting-costs hypothesis, which states that costs of expected investment-related conflicts between shareholders and bondholders (e.g., the asset substitution problem, the underinvestment problem) are reflected in the firms' capital structure choices. That is, firms choose financial structures that reduce the incentives of shareholders to deviate from the optimal investment policy. The contracting-costs hypothesis is supported empirically. Smith and Watts (1992), Barclay and Smith (1995a, 1995b), and Rajan and Zingales (1995) provide evidence indicating that expected agency costs affect the structure of debt.

Since this study identifies an incentive of shareholders to engage in poor investments only when the convertible debt is non-subordinated, I predict that firms with greater potential for investment-related shareholder-bondholder conflicts are more likely to issue convertible debt that is subordinated.

The second implication follows directly from the potential incentive of shareholders to prefer negative-NPV projects over positive-NPV projects in the presence of non-subordinated convertible debt. I predict that firms with senior convertible debt are more

likely than firms with subordinated convertible debt to deviate from the optimal investment policy.

3.2 Data

I test the two implications of the theory using two distinct sets of data. For the first implication I use all firm-years with new issues of convertible debt appearing in the Securities Data Corporation (SDC) database. The sample contains 2,014 new issues sold by 1,609 firms between 1970 and 2004, of which 1,779 (88%) are subordinated. The high percentage of subordinated debt is comparable to that in prior studies (see Wilson and Fabozzi, 1996; Krishnaswami and Yaman, 2004), and is consistent with the theory developed in this study. For the second implication I use all firm-years with convertible debt appearing in Compustat, where for both samples, the financial and accounting data required to test the model's implications are obtained from the CRSP/Compustat intersection, as described below.

3.3 Variable estimation

Testing the implications of the theory requires measures of the potential for agency conflicts and the extent of investment distortion.

3.3.1 Potential for investment-based agency conflicts

I consider a variety of factors that indicate the potential of a firm to deviate from the optimal investment policy.

Investment opportunity set. The agency conflict identified in this study is between bondholders and shareholders as to the firm's investment decisions. Thus, this conflict, as with any other investment-related agency conflict, is more likely to occur when firms have more investment opportunities (see Smith and Watts, 1992; Barclay and Smith,

1995a, 1995b, on the relation between investment opportunities and expected agency costs). I therefore predict that firms with more investment opportunities (measured by the market-to-book ratio) issue more subordinated convertible debt.

Size. Large firms are usually less exposed to agency conflicts; they are less likely to default because they have access to a wider variety of financing channels, and also have a better reputation in the debt market (see Diamond, 1993). Large firms also typically attract more attention in the financial markets than small firms, which reduces their flexibility to deviate from the optimal investment policy. Consistent with this argument, prior studies find that small firms typically choose capital structure that reduces expected agency costs (see, for example, Blackwell and Kidwell, 1988; Titman and Wessels, 1988; Barclay and Smith, 1995a, 1995b; Rajan and Zingales, 1995). I therefore predict that small firms are more likely to issue subordinated convertible debt.

Managerial ownership. While the investment-based conflict presented here is between shareholders and bondholders, the investment decisions are made by the firm's managers. Although managers are assumed to represent the shareholders, they often have their own set of interests, such as reputation, compensation, and empire-building. Thus, shareholder-bondholder conflicts depend on the extent to which manager and shareholder interests are aligned. I measure the association between the interests of managers and shareholders by the percentage of equity owned by the firm's top management (see, for example, Morck, Shleifer, and Vishny, 1988; Mehran, 1995), and predict that firms with higher managerial ownership issue more subordinated convertible debt. Data on managerial ownership are taken from the ExecuComp database.²

² The ExecuComp database covers a relatively short period. Therefore, to maintain sample size I estimate missing values of managerial ownership using the regression imputation method (see Eisdorfer, 2008).

Regulation. Smith (1986) argues that managers of regulated firms have less discretion over investment decisions than managers in unregulated firms. This implies that deviation from optimal investment policy, including choosing poor projects to prevent debt conversion, is less likely to occur in regulated firms. Thus, I predict that unregulated firms are more likely to issue subordinated convertible debt. Following Hermalin and Weisbach (1988), I consider public utilities (SIC code 49), airlines and railroads (SIC codes 40-47), and financial institutions (SIC codes 60-69) as regulated industries.

Homogeneity. Managers have less operational flexibility in more homogeneous industries, and hence are less expected to deviate from the optimal investment policy than managers in heterogeneous industries. Parrino (1997) further argues that monitoring manager performance is more effective in homogeneous industries, which implies that bondholders are better able to detect changes in the firm's investment policy in homogeneous industries. I thus predict that subordinated convertible debt is more likely to be issued in less homogeneous industries. To classify industries as either homogeneous or heterogeneous I use Parrino's proxy for the degree of industry homogeneity.

3.3.2 Investment distortion measures

My model predicts that in the presence of senior convertible debt, shareholders can have incentives to reduce firm value by deviating from optimal investment policy, where the investment distortion can take the form of both overinvestment (if accepting negative NPV projects) and underinvestment (if rejecting positive NPV projects). I measure the extent to which a firm deviates from its optimal investment policy by comparing actual and expected investment.³ Actual investment is estimated by capital expenditures divided

³ Recent studies that also measure investment distortions by the difference between actual and expected investment are, for example, Titman, Wei, and Xie (2004) and Richardson (2006).

by asset value at the beginning of the year (see, for example, Kaplan and Zingales, 1997; Mayers, 1998; Korkeamaki and Moore, 2003).⁴

I use three proxies for the firm's expected investment. The first proxy is the median investment in the industry in each year. The second proxy is the fitted value from industry-year cross-sectional regressions of the firms' actual investment on Tobin's Q ratios (measured by the market-to-book equity ratio as of the beginning of the year). The third proxy is the fitted value from a pooled regression of the firms' actual investment on a set of variables that have been found to explain investment in prior studies: size, market-to-book ratio, leverage (all as of the beginning of the year), lagged cash flow from operations, stock return in the previous year, industry dummy, and year dummy (see, for example, Fazzari, Hubbard, and Petersen, 1988; Lang, Ofek, and Stulz, 1996). Using these three proxies, the investment distortion is defined by the absolute value of the difference between a firm's actual investment and its expected investment.

3.4 Descriptive statistics

Table 1 presents descriptive statistics for the SDC's sample of new convertible debt issues and for the Compustat's sample of firm-years with convertible debt. For firms to be included in the samples, they must have the priority status of the convertible debt and the variables required for computing the measures described above. In addition, firm-years with extreme values are excluded from the samples. After including all firms traded on the NYSE, Amex, and Nasdaq that satisfy these conditions, the two samples contains 1,249 and 20,616 firm-year observations, respectively, over the period 1970-2004.

There are no significant differences between the two samples, and the estimates are comparable to values reported in other studies, except for leverage, which is relatively

⁴ The results are robust to other common measures of investment.

high in my samples (means of 0.38 and 0.36). This might be because my samples do not contain all-equity financed firms.

3.5 Results

Table 2 addresses the first implication of the theory by examining the effect of the potential for agency conflicts on the priority status of new issues of convertible debt. Column A shows the results of a logit regression of a dummy variable that equals one if the convertible debt is subordinated, and zero if senior, on the variables associated with expected shareholder-bondholder conflicts (market-to-book ratio, size, managerial ownership, regulation, and homogeneity). The regression also includes a dummy variable that equals one if the firm's capital structure already includes subordinated standard debt, and zero otherwise. This variable should capture the ability of firms to issue new debt with senior priority status, mainly driven by the existence and tightness of debt covenants that prohibit such issuance. To control for industry and time effects on the priority status, I also examine the results using fixed effects regressions for each two-digit SIC code and year in the sample (reported in Columns B and C).

The results of all regressions strongly support the model's prediction that firms with greater potential for investment-related agency conflicts tend to issue convertible debt that is subordinated. Specifically, subordinated convertible debt is more likely to be issued by firms with high market-to-book ratios, by smaller firms, by firms with high managerial ownership (the p -values of these variables range from less than 0.001 to 0.036), and by unregulated firms (p -values of 0.029 and 0.047 in the main and fixed year effects regressions). The industry homogeneity coefficient is also of the predicted sign, but not always significant.

The results are also meaningful in economic terms. Consider the main regression, for example, an increase in the market-to-book ratio from one standard deviation below its mean to one standard deviation above increases the likelihood that the convertible debt is subordinated by 0.06. Similar increases in firm size (in log terms) and managerial ownership change the likelihood that the convertible debt is subordinated by 0.2 and 0.043, respectively; and a change in the regulatory status of the firm changes the likelihood that the convertible debt is subordinated by 0.082.

Table 3 addresses the second implication of the theory. I regress the three investment distortion measures on a dummy variable that indicates whether the firm's convertible debt is subordinated,⁵ and on a set of control variables that are likely to affect deviation from optimal investment: market-to-book ratio, size, cash flow, managerial ownership, and the extent of financial distress (measured by Altman's 1968 Z-score model of bankruptcy prediction).⁶ Note first that the coefficients of the control variables all indicate that firms that are more subject to investment-related shareholder-bondholder conflicts (i.e., growth firms, financially distressed firms, etc.) tend to have more investment distortions, which is consistent with the agency theory research (e.g., Jensen and Meckling, 1976; Myers, 1977; Smith and Warner, 1979; Stulz and Johnson, 1985; Smith and Watts, 1992). More specifically, the results based on all three measures show that firms with senior convertible debt at the beginning of the year are more likely to exhibit investment distortion during the year (the *p*-values of the subordinated convertible dummy variable are between 0.009 and 0.027). This finding is consistent with the

⁵ Data on the priority status of existing convertible debt are taken from Compustat. For almost all firm-years in the sample (around 97%), the convertible debt is either entirely subordinated or entirely senior, which allows the use of the priority status dummy variable in the regressions.

⁶ $Z\text{-score} = 1.2(\text{working capital}/\text{total assets}) + 1.4(\text{retained earnings}/\text{total assets}) + 3.3(\text{earnings before interest and taxes}/\text{total assets}) + 0.6(\text{market value of equity}/\text{book value of total liabilities}) + 0.999(\text{sales}/\text{total assets})$.

model's prediction that the presence of non-subordinated convertible debt can produce shareholder incentives to deviate from the optimal investment policy.

The relation between investment distortion and the priority status of convertible debt tested in Table 3 could involve an endogeneity problem. That is, on the one hand firms with a greater potential to deviate from the optimal investment policy are more likely to issue subordinated convertible debt (i.e., a positive relation), and on the other hand the presence of subordinated convertible debt reduces the incentive to distort investment policy (i.e., a negative relation). The control variables included in Table 3 are supposed to mitigate this endogeneity effect; i.e., the results in the table indicate that holding the expected investment distortion constant, subordinated convertible debt reduces the extent of the actual investment distortion.

To further examine the robustness of the results in Table 3 to potential endogeneity effects, I employ a two-stage least squares (2SLS) regression. In the first stage I run a logit regression of a dummy variable that indicates whether the firm's convertible debt is subordinated on a set of exogenous variables (size, market-to-book ratio, and managerial ownership) and two instrumental variables that are correlated with the priority status of convertible debt, and not correlated with investment distortion. The first one is a dummy variable that indicates whether the firm's capital structure includes subordinated standard debt (as appears in Table 2), and the second one is the fraction of the firm's debt that is secured. The justification for the latter is that the presence of secured debt mitigates the incentive of the current bondholders to prohibit the issuance of non-subordinated debt. This regression generates the probability that the firm's convertible debt is subordinated.

In the second stage I run a similar regression to that in Table 3, where the investment distortion is regressed on the generated probability of subordinated convertible debt,

instead of the subordinated convertible debt dummy variable. The results of the second-stage regression reported in Table 4 are consistent with the results in Table 3. The coefficients of the generated probability that the convertible debt is subordinated are negative and significant (p -values between 0.003 and 0.066), suggesting that the observed ability of junior convertible debt to mitigate investment distortion is not driven by endogeneity.

4. Conclusions

This study offers an explanation for the junior priority status of convertible debt that is based on an investment-related conflict between shareholders and bondholders. When a firm has convertible debt in its capital structure, every investment decision affects not only the value of the firm, but also the likelihood that the debt will be converted. Since debt conversion has implications for equity value, when shareholders accept a project, their benefit comprises the NPV of the project and the NPV of the change in the likelihood of conversion.

I show that providing convertible bondholders with the same priority rights as straight bondholders can give shareholders an incentive to accept negative-NPV projects to prevent debt conversion, and thereby to dilute the value of the non-convertible debt instead of the value of the equity. I prove that when convertible debt is subordinated, there is no such potential problem.

The empirical evidence supports the theory. I find that firms with greater potential for investment-based agency conflicts are more likely to issue subordinated convertible debt, and that firms with senior convertible debt are more likely to deviate from the optimal investment policy.

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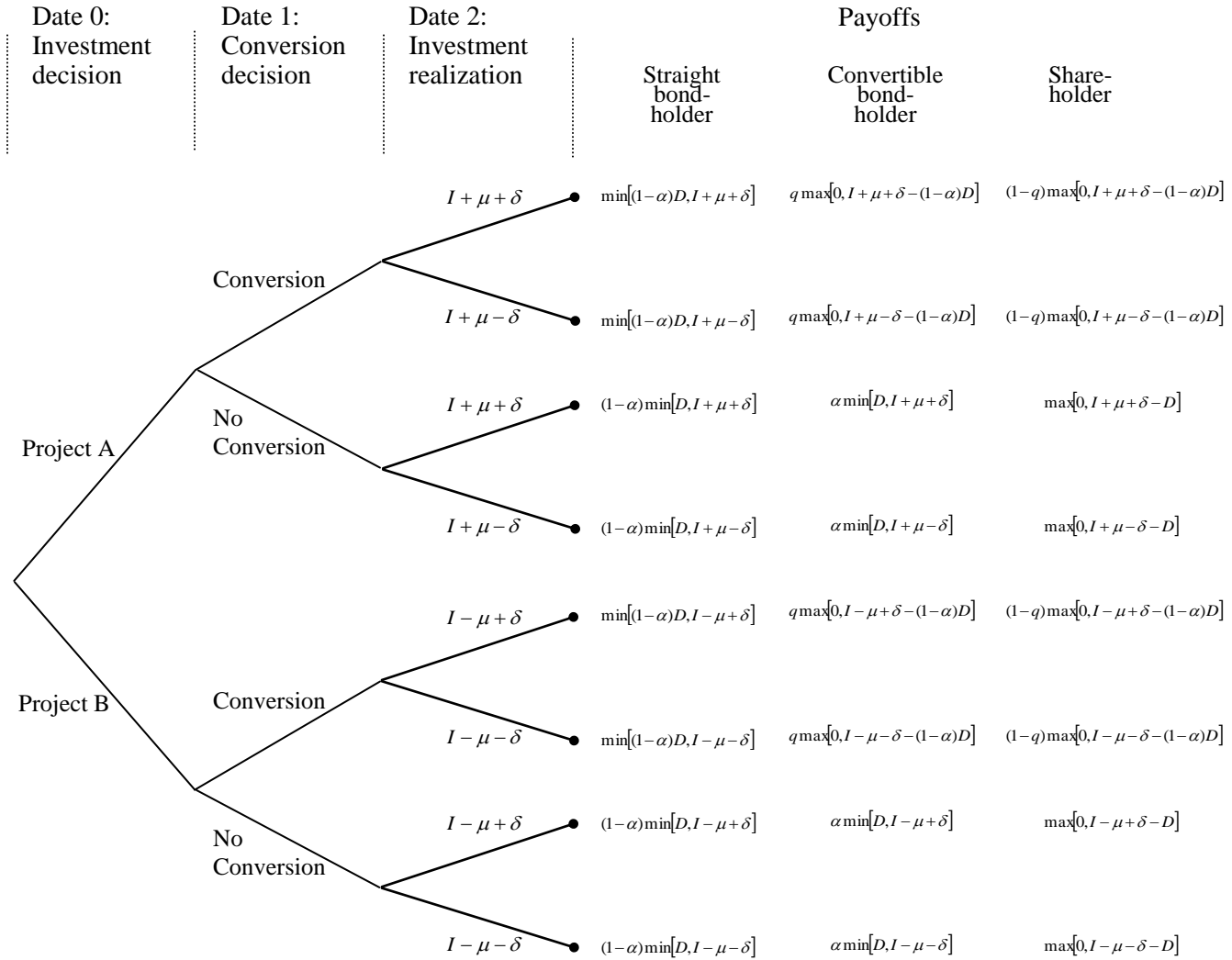


Figure 1. Payoff structure when convertible debt and straight debt have equal priority. The figure presents the payoffs to the straight bondholder, the convertible bondholder, and the shareholder when the bonds have equal priority status, as a function of the parameters: I is the initial amount of cash held by the firm that is required for the project; D is the face value of the firm's total debt; α is the share of convertible debt in the total debt; q is the share of the equity that will be held by the convertible bondholder upon conversion; μ and δ represent the projects' payoffs properties, where project A will generate either $[I + \mu + \delta]$ or $[I + \mu - \delta]$ with equal probability, and project B will generate either $[I - \mu + \delta]$ or $[I - \mu - \delta]$ with equal probability.

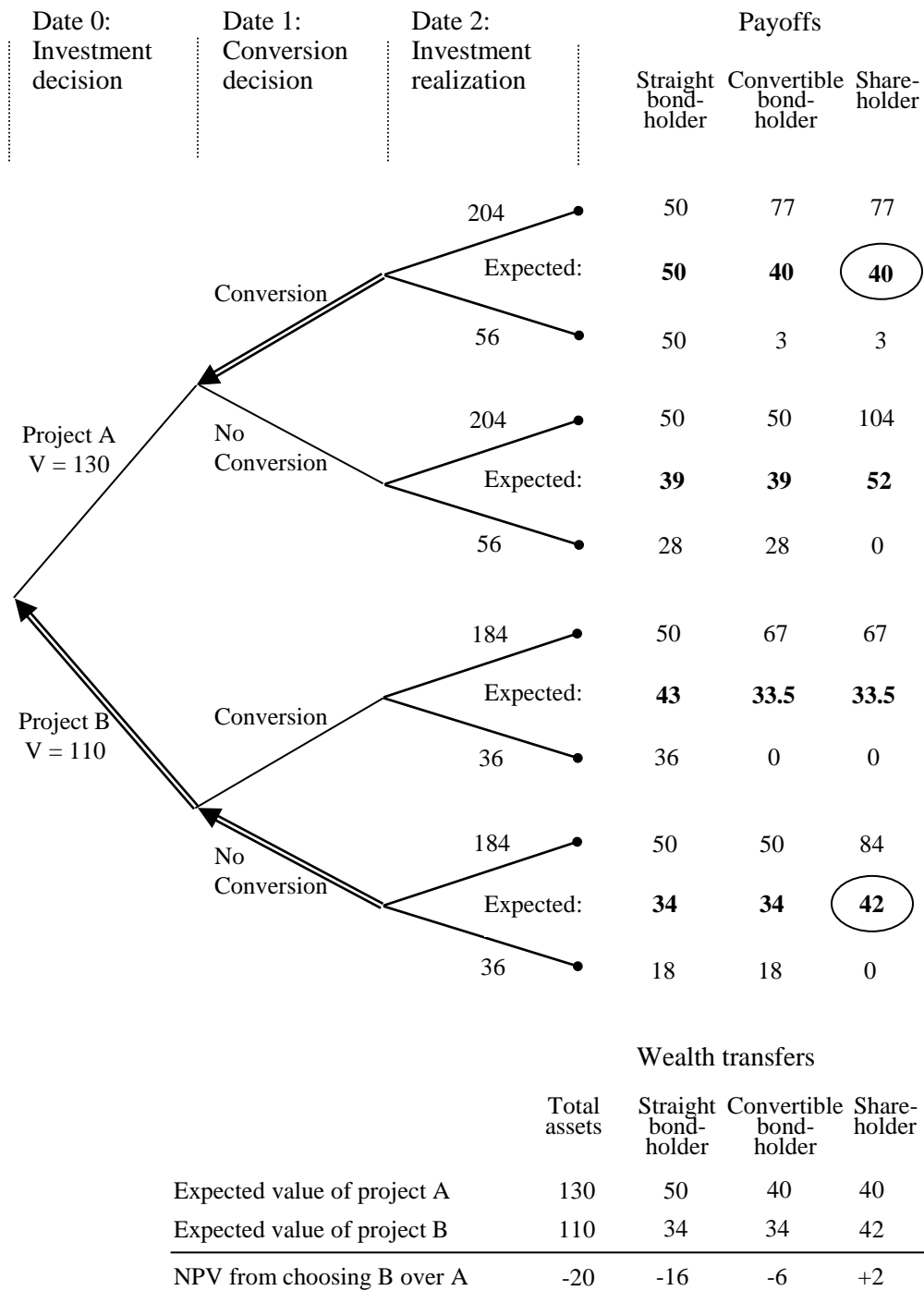


Figure 2. Payoff structure and wealth transfers when convertible debt and straight debt have equal priority - A numerical example. The figure presents a specific case of the payoff structure presented in Figure 1 and a summary of the wealth transfers for the following parameter values: $I = 120$, $D = 100$, $\mu = 10$, $\delta = 74$, $\alpha = 0.5$, $q = 0.5$.

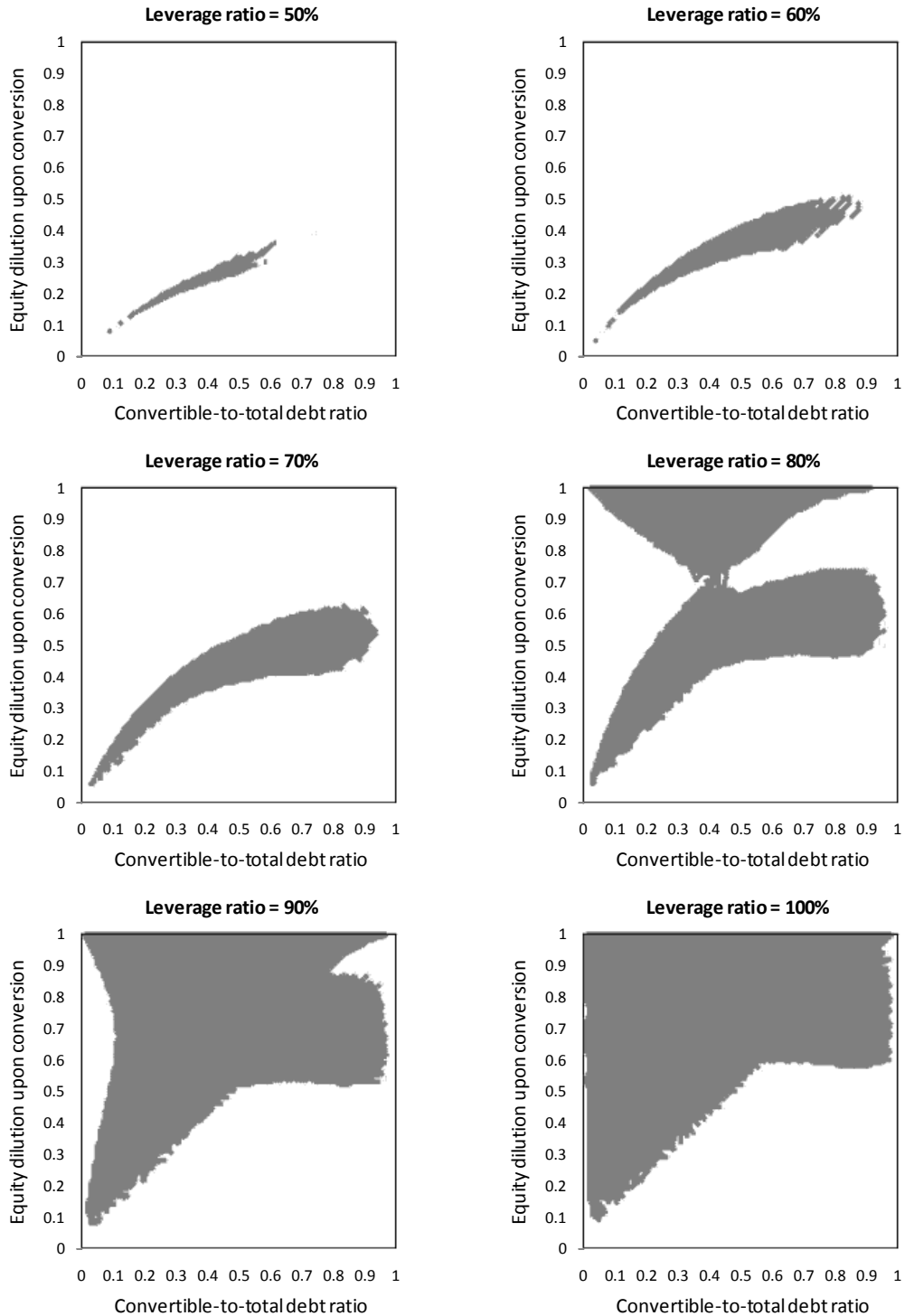


Figure 3. The parameter values under which the agency problem can arise when convertible debt and straight debt have equal priority. Leverage ratio is the face value of debt (D) divided by the initial amount of cash held by the firm that is required for the project (I). Convertible-to-total debt ratio is the share of convertible debt in the total debt (α). Equity dilution is the share of the equity that will be held by the convertible bondholder upon conversion (q). The shaded areas indicate the values ($D/I, \alpha, q$) for which there exists a set of pairs of projects with a positive and a negative NPV ($\mu > 0$ and $-\mu$, respectively) and the same volatility (δ), such that the shareholder will be better off with the negative-NPV one.

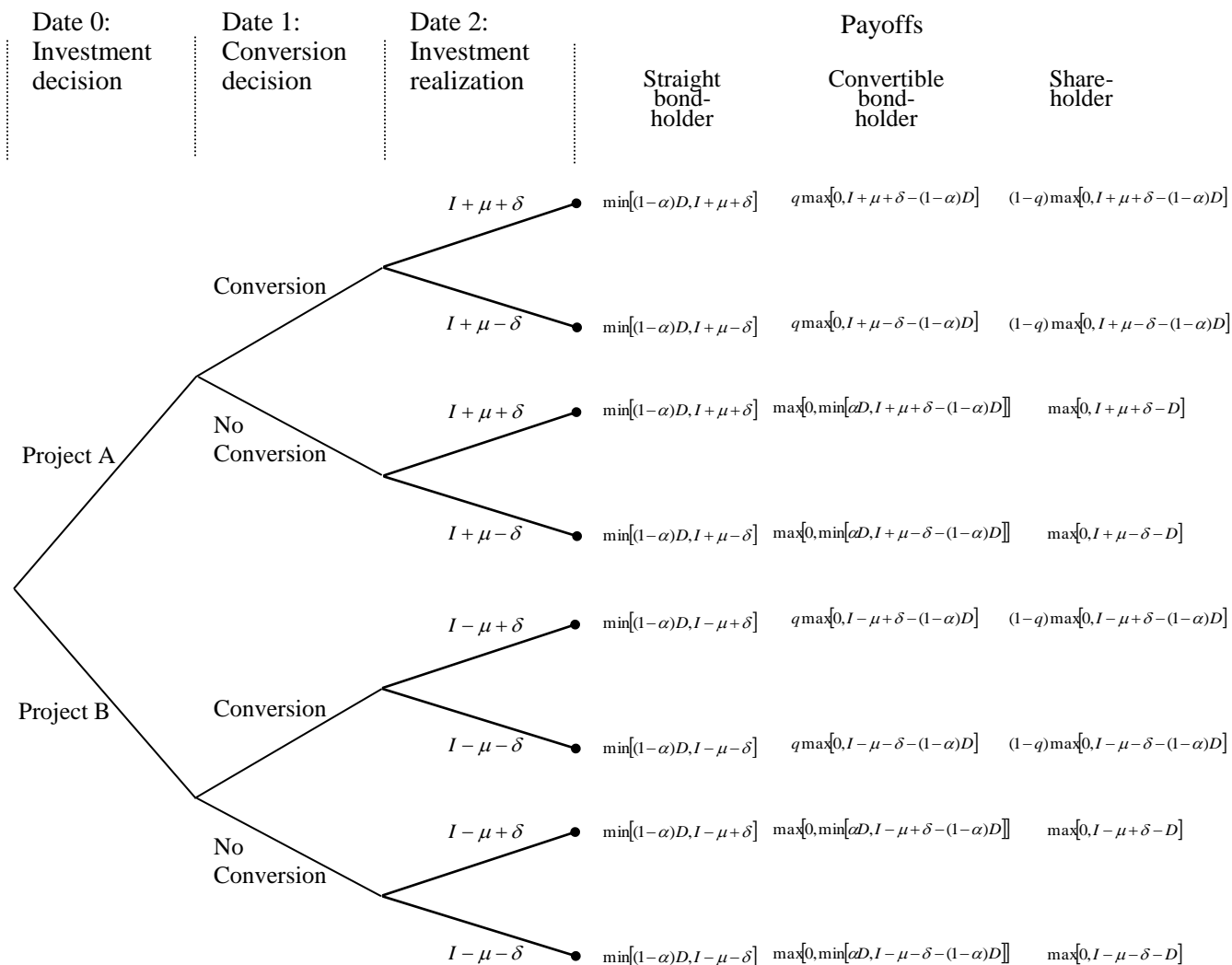


Figure 4. Payoff structure when convertible debt is subordinated to straight debt.

The figure presents the payoffs to the straight bondholder, the convertible bondholder, and the shareholder when the convertible bond has a lower priority status, as a function of the parameters: I is the initial amount of cash held by the firm that is required for the project; D is the face value of the firm's total debt; α is the share of convertible debt in the total debt; q is the share of the equity that will be held by the convertible bondholder upon conversion; μ and δ represent the projects' payoffs properties, where project A will generate either $[I + \mu + \delta]$ or $[I + \mu - \delta]$ with equal probability, and project B will generate either $[I - \mu + \delta]$ or $[I - \mu - \delta]$ with equal probability.

Table 1
Descriptive statistics

The sample in the upper box includes all firms with new issues of convertible debt that appear in the SDC database, and that have CRSP/Compustat data, over the period 1970-2004 (total of 1,249 firm-years). The sample in the lower box includes all firms with convertible debt that appear in Compustat over the same period (total of 20,616 firm-years). For all variables, observations outside the top and the bottom percentiles are excluded. P25, P50, and P75 indicate the 25th, 50th, and 75th percentiles, respectively, of each variable. Firm size is the natural log of the firm's equity value (in millions of dollars), measured by the stock price multiplied by the number of shares outstanding. Market-to-book ratio is the equity market value divided by the equity book value. Leverage is the book value of total liabilities as a fraction of the book value of total assets. Cash flow is the firm's operating cash flow divided by the book value of total asset at the beginning of the year. Investment is capital expenditures divided by the book value of total assets at the beginning of the year. The Z-score is based on Altman's (1968) model for predicting bankruptcy. Managerial ownership is the percentage of equity owned by the firm's top management.

SDC: New issues of convertible debt					
	Mean	StdD	P25	P50	P75
Log_size	12.48	1.88	11.21	12.38	13.70
Market-to-book	2.65	2.40	1.29	1.94	3.14
Leverage	0.38	0.17	0.26	0.37	0.49
Cash flow	0.17	1.56	0.11	0.19	0.31
Investment	0.10	0.09	0.03	0.07	0.13
Z-score	3.18	2.67	1.91	2.80	3.99
Managerial ownership	4.63	6.98	3.22	4.66	5.20
Compustat: Firm-years with convertible debt					
	Mean	StdD	P25	P50	P75
Log_size	10.76	2.02	9.27	10.60	12.16
Market-to-book	2.01	2.52	0.70	1.28	2.32
Leverage	0.36	0.16	0.24	0.35	0.46
Cash flow	0.10	5.50	0.08	0.15	0.24
Investment	0.09	0.09	0.03	0.06	0.11
Z-score	2.66	2.32	1.58	2.48	3.45
Managerial ownership	5.03	4.53	4.34	5.06	5.58

Table 2
Regressions of the priority status of convertible debt on factors representing the potential for investment-based agency conflicts

The sample includes new issues of convertible bonds taken from the SDC database. Column A shows a logit regression of a dummy variable that equals one if the convertible debt is subordinated, and zero if senior, on the following variables: market-to-book ratio is the equity market value divided by the equity book value; firm size is the natural log of the market value of the firm's equity; managerial ownership is the percentage of equity owned by the firm's top management; regulation dummy is equal to one if the firm is regulated, and zero otherwise, where public utilities (SIC code 49), airlines and railroads (SIC codes 40-47), and financial institutions (SIC codes 60-69) are considered as regulated industries; homogeneity dummy is equal to one if the firm belongs to an homogeneity industry, and zero otherwise, based on the Parrino's (1997) homogeneity measure; sub. standard debt dummy is equal to one if the firm's capital structure includes subordinated standard debt, and zero otherwise. Column B shows a similar regression with fixed industry effects based on two-digit SIC codes, and Column C shows a similar regression with fixed year effects. The table shows the coefficients and their *p*-values, based on White (1980) heteroskedasticity-consistent standard errors. The results are based on 1,249 observations over the period 1970-2004.

	Predicted sign	A Main regression	B Fixed industry effects	C Fixed year effects
Intercept		10.519 (<0.001)	9.711 (<0.001)	4.314 (0.001)
Market-to-book	+	0.369 (0.002)	0.313 (0.019)	0.300 (0.036)
Log_size	-	-0.686 (<0.001)	-0.748 (<0.001)	-0.357 (<0.001)
Managerial ownership	+	0.066 (0.004)	0.101 (0.027)	0.111 (0.030)
Regulation dummy	-	-0.658 (0.029)	1.499 (0.325)	-0.745 (0.047)
Homogeneity dummy	-	-0.439 (0.108)	-1.446 (0.203)	-0.764 (0.023)
Sub. standard debt dummy	+	0.762 (0.096)	1.106 (0.030)	0.757 (0.164)

Table 3**Regressions of investment distortion on the priority status of convertible debt**

The sample includes only firms with convertible debt. The dependent variable is the firm investment distortion, defined as the difference between actual and expected investment. Actual investment is measured by capital expenditures divided by the book value of total assets at the beginning of the year. I use three measures of expected investment. The first is the median investment in the industry, based on the four-digit SIC code. If the four-digit category contains fewer than five observations, I use a three-digit code, and if that contains fewer than five observations, I use a two-digit code (see Lang, Ofek, and Stulz, 1996, for a similar procedure). The second is the fitted values from industry-year cross-sectional regressions of investment on Tobin's Q ratio, measured by market-to-book ratio of equity. The cross-sectional regressions are estimated for all two-digit SIC codes with at least 20 observations in a given year. And the third is the fitted values from a pooled regression of actual investment on size, market-to-book ratio, leverage (all as of the beginning of the year), lagged cash flow from operations, stock return in the previous year, industry dummy, and year dummy (referred to in the table as Models I, II, and III, respectively). The independent variables are: a dummy variable that equals one if the convertible debt is subordinated, and zero if senior; the market-to-book ratio, estimated by the equity market value divided by the equity book value; firm size, estimated by the natural log of the market value of the firm's equity; cash flow, estimated by the ratio of operating cash flow to book value of total assets at the beginning of the year; managerial ownership, which is the percentage of equity owned by the firm's top management; and the Z-score, which is based on Altman's (1968) model for predicting bankruptcy. The regressions are Fama-MacBeth (1973) with annual cross-sections. The reported coefficients are the averages of the coefficients in the cross-sectional regressions, and the *p*-values are based on the time series standard errors of the coefficients. The results are based on 20,616 firm-years over the period 1970-2004.

	Investment distortion Model I	Investment distortion Model II	Investment distortion Model III
Intercept	0.0559 (<0.001)	0.0627 (<0.001)	0.0660 (<0.001)
Sub. convertible dummy	-0.0057 (0.009)	-0.0045 (0.027)	-0.0056 (0.019)
Market-to-book	0.0082 (<0.001)	0.0075 (<0.001)	0.0075 (<0.001)
Log_size	-0.0020 (<0.001)	-0.0020 (<0.001)	-0.0024 (<0.001)
Cash flow	0.0138 (0.016)	0.0246 (0.015)	0.0185 (0.071)
Managerial ownership	0.0011 (0.003)	0.0009 (0.004)	0.0010 (<0.001)
Z-score	-0.0036 (<0.001)	-0.0053 (<0.001)	-0.0049 (<0.001)

Table 4
2SLS regressions of investment distortion on the probability that the convertible debt has junior priority status

The table shows the results of a second-stage regression of a two-stage least squares (2SLS) procedure. In the first stage I run a logit regression of a dummy variable that indicates whether the firm's convertible debt is subordinated on a set of exogenous variables (size, market-to-book ratio, and managerial ownership, as described in Table 2) and two instrumental variables: a dummy variable that indicates whether the firm's capital structure includes subordinated standard debt, and the fraction of the firm's debt that is secured. This regression generates the probability that the firm's convertible debt is subordinated. In the second stage I run a similar regression to that in Table 3, where the investment distortion is regressed on the generated probability of subordinated convertible debt, instead of the subordinated convertible debt dummy variable. The regressions are Fama-MacBeth (1973) with annual cross-sections. The reported coefficients are the averages of the coefficients in the cross-sectional regressions, and the p -values are based on the time series standard errors of the coefficients. The results are based on 20,616 firm-years over the period 1970-2004.

	Investment distortion Model I	Investment distortion Model II	Investment distortion Model III
Intercept	0.0948 (<0.001)	0.0907 (<0.001)	0.0875 (<0.001)
P(Sub. convertible debt)	-0.0665 (0.016)	-0.0484 (0.003)	-0.0398 (0.066)
Market-to-book	0.0079 (<0.001)	0.0065 (<0.001)	0.0066 (<0.001)
Log_size	-0.0009 (0.293)	-0.0011 (0.065)	-0.0016 (0.014)
Cash flow	0.0098 (0.128)	0.0121 (0.010)	0.0116 (0.015)
Managerial ownership	0.0006 (0.075)	0.0003 (0.233)	0.0005 (0.030)
Z-score	-0.0029 (0.012)	-0.0039 (<0.001)	-0.0038 (<0.001)